few critical degrees. Nonetheless, the colony's small size makes it very vulnerable to use of insecticides, change in land use, or irresponsible collecting.

It is difficult to say whether single specimens collected around London are the result of natural dispersal from existing populations, or whether they represent independent introductions with newly purchased plants or substrate from infested garden centres or abroad. Unlike many *Chrysolina*, *C. americana* is able to fly (Jolivet, 1997). The rosemary in the Walton Street garden was long established, while the plants in the Barnes garden appeared to be newly planted. Although apparently suitable patches of lavender exist all over London (where it is a ubiquitous street plant) the beetle is still extremely patchily distributed.

On 22.iii.2002 a female *C. americana* was noted on the wall in Imperial Road by MVLB suggesting that the species had successfully overwintered at this site. On 5.vi.2002 a specimen was brought to MVLB from Lavender in a garden at Merton Park, Wimbledon (VC17:TQ2469) by A. Galsworthy.

Our thanks to R.T. Thompson, P.R. Kirwan-Taylor and A. Galsworthy for allowing us to use their London records of *C. americana*. Thanks also to Andrew Salisbury and Duncan Sivell for helpful comments.

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SHORT COMMUNICATION

A gynandromorph of *Gonepteryx cleopatra* L. (Lepidoptera: Pieridae).—Purchased at the 1999 Amateur Entomologists' Society annual exhibition from Nigel South of Misterton, Somerset, who took it at Párga, Greece (39° 18′ N, 20° 23′ E) in May 1998, and presented at the 1999 BENHS annual exhibition (*British Journal of Entomology and Natural History*, **13**(3) p. 153 Plate 2, Fig. 10). The specimen is predominantly male with areas of pale green/white female coloration on all the wing surfaces. The data and dull yellow underside patches identify it as *G. c. cleopatra* f.

italica Gerhard (=f.*massilensis* Foulquier) (Tolman & Lewington, 1997). Photomicrographs were exhibited showing selected upperside details.

In mammals, the sex of an individual is determined indirectly by the sex chromosomes it carries, through the kinds and relative proportions of the sex hormones thus produced in the gonads and circulating in the blood. Females carry two 'X' chromosomes (denoted 'XX'), on account of whose likeness they are referred to as the homogametic sex, while males carry one X and a dissimilar 'Y' (denoted 'XY') and represent the heterogametic sex (Ford, 1957). In Lepidoptera, in contrast, it is the male which is homogametic and the female heterogametic, with the 'X' and 'Y' equivalents being denoted instead as the 'Z' and 'W' chromosomes respectively (Harmer, 2000). Furthermore, in Lepidoptera the sex of each cell is determined directly by the two sex chromosomes contained therein. Development proceeds through the process of cell division. The two sex chromosomes in the 'parent' cell are duplicated, and the cell then divides in such a way that each of the two 'progeny' cells receives one copy of each of the two 'parent' chromosomes. Thus a male ZZ cell will divide to give two ZZ cells, and a female ZW cell will give two ZW cells, with normal individuals comprising cells all of the same sex (Ford, 1957).

However, abnormalities in cell division may occur and can produce gynandromorphs (Ford, 1957). The key determinant of sex is the number of Z-chromosomes (two in males, one in females) which provide the deciding balance of male-determining genes, rather than the presence or absence of a W which is functionless in determining sex. Cells receiving any other number of Zs die. In the *G. cleopatra*, tissue that would normally have developed as male has developed as female. Such a condition can arise in two ways. The first is the loss of one of the duplicated Z-chromosomes in a dividing parent cell, resulting in one ZZ and one Z progeny cell. The second is an unequal allocation of the duplicated Z-chromosomes to the progeny cells, so that one becomes ZZZ and dies while the other becomes Z. In both cases the 'Z' cell will be female and continue to divide as such, resulting in a mosaic of male and female tissue. When the loss of a Z occurs in the egg at the first cell division, a bilateral gynandromorph results.

Should the duplicated Zs in a dividing ZW cell be unequally allocated to the progeny cells, then one of them becomes ZZW and thus male, while the other becomes W and dies. This mechanism cannot therefore produce the bilateral condition.

Gynandromorphs are distinct from 'intersexes' which result from too even a balance between the number of male-determining genes on the Z-chromosomes and female-determining genes on the non-sex chromosomes or 'autosomes'. This can arise when individuals from locally evolved populations interbreed, or when species are hybridised. Intersexes are also distinct in that they start developing as one sex but later switch to the other, and thus can have structures of an intermediate type. Gynandromorphs and intersexes are both forms of 'hermaphrodite', which describes any animal where the two sexes are combined, by whatever means (Ford, 1957).

Gynandromorphs represent a class of homoeotic transformation, where tissue typical of one part of an organism develops at a position typical of another tissue type. In gynandromorphs, pattern features typical of one sex develop at the corresponding position in the other sex (Nijhout, 1991). In common with many gynandromorphs, the *G. cleopatra* showed several unconnected and variably sized patches of transformed tissue spread randomly across the wings, a pattern of transformation commonly referred to as a 'mixed gynandromorph', and the specimen described above represents the only case known to the author of a predominantly male mixed gynandromorph of the species: a predominantly female mixed gynandromorph of *G. c. cleopatra* taken by R. W. Parfitt in 1974 at St Tropez, France (43° 16′ N, 6° 39′ E), and currently in the possession of Peter May of Bognor Regis, W. Sussex, was presented at the Amateur Entomologists' Society's Annual Exhibition at Kempton Park, London on 7.xii.2000. In Lepidoptera, each wing scale represents a single cell of one colour-type only. Assuming each patch of cells to have originated from (and so be a 'clone' of) a single mutated cell, the transformation must have occurred many times independently on different parts of the wings.

The cause of such mutations is not well understood, but the resemblance of gynandromorphs to the somatic variegation known in plants and vertebrates suggests they may be due to transposable genetic elements that move and insert themselves at points in the chromosome DNA (Nijhout, 1991). Environmental stress can increase the rate of transposition, and some transposable elements may be able to move between cells as appears to be the case in fruit flies, *Drosophila* (Pollard, 1988). Indeed this might explain the occurrence of the gynandromorphism on all eight wing surfaces, despite the establishment during development, of autonomous developing regions or 'compartments' whose boundaries homoeotic clones cannot cross (Sibatani, 1980; Goodwin, 1984; Ho, 1992). Alternatively, transposable elements could have been already present in each compartment, but separately activated.

I thank Barry Lockyer of the School of Biological Sciences, Southampton University, for his assistance in producing the photomicrographs, and Peter May for permission to cite the additional record.—LEONARD WINOKUR, Flat 3, Charles Court, 7 Darwin Road, Southampton, Hampshire SO15 5BS.

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